INSTITUTION OF CIVIL ENGINEERS.

February 13.—George Rennie, Esq., in the chair.

A paper by Mr. J. Grantham described a series of experiments on an iron vessel called the "Liverpool Screw." This boat was 65 feet long, 12 feet 6 inches beam, and had 3 feet 9 inches draught of water; she was propelled by two high-pressure oscillating engines, with cylinders 13 inches diameter and 18 inches stroke; the pressure of the steam in the boiler varied from 50 lbs. to 60 lbs. per square inch, and it was cut off at one-fourth of the length of the stroke, working the remainder by expansion. The nominal power was 20 horses, but it did not really exceed 18½ horses. The cylinders were placed diagonally, with both the piston-rods working upon the same crank, the driving-shaft being beneath the cylinders and running direct to the propeller, without the intervention of either gearing or bands.

The screw-propeller was enlarged three times, and at last was left at 5 feet 4 inches diameter, by 20 inches in length; it was set out with a pitch expanding from 10 to 11 feet, on Woodcroft's plan; it was made of wrought iron, with four short arms with broad shovel ends, whose united area was 16 square feet, 13 feet only of it being immersed, as some portion of the arms was constantly above the water; the angle of the centre of the float was 45°. The speed of the propeller was generally 95 revolutions per minute.

With these dimensions, the speed attained was described as 10½ statute miles per hour. The amount of "slip" of the screw in the water, as ascertained by Massey's log, was stated not to exceed 5 per cent. Several experiments were detailed, which shewed that there was not more tendency to "list" or to turn round by the action of the screw than with paddle-wheels, and the vessel was said to have excelled all the other steamers of the port of Liverpool in towing out vessels in a rough sea.

Designs were submitted on this principle for a steam frigate, and for large steamers working with oscillating cylinders direct upon the main shaft.

In the discussion which ensued, the various forms and modifications of screw-propellers and their relative merits were very ably treated by a number of speakers.

Mr. Rennie gave a sketch of the introduction of a kind of screw used by Mr. S. Brown with his gas-engine, which was tried on the Thames; the more successful attempt of Mr. Smith, and the building of the Archimedes and other vessels; he mentioned also the claim of M. Sauvage, of Boulogne, to the invention, and his being recently rewarded by the King of the French. Mr. Rennie entered largely into the theory of the forms of the propellers, and in this he was followed by Mr. Farey, Mr. Galloway, Mr. Samuda, and others; and M. Normand, of Havre, who is celebrated for giving such superior forms to the vessels built by him, gave a slight sketch of the Napoléon French frigate, in which he eulogised the engines constructed by Mr. Barnes, and the general result obtained with the vessel, but it appeared that the speed was not superior to what had been obtained with paddle-wheels.

A model was exhibited by permission of Sir H. T. de la Bêche from the Museum of Economic Geology, shewing all the kinds of valves used in the pumps for draining the Cornish mines, and the merits and defects of the various kinds were very ably explained and commented upon by Mr. Jordan, under whose directions the model was constructed. Mr. John Taylor gave an historical sketch of the introduction of the various improvements, the causes which led to them, and the effects they had produced: the length of the discussion upon the screw-propeller left so little time for the subject of the valves, that it was announced to be renewed at the next meeting, Tuesday, Feb. 20th, when the following papers will be read:—

No. 598. "Description of a bridge across the river Shannon at Portumna," by T. Rhodes, M. Inst. C.E.

No. 658. "Description of a bridge over the river Whitadder at Allanton," by J. T. Syme.

No. 625. "Description of a cast and wrought-iron trussed girder for bridges, with a series of experiments on their strength," by F. Nash.

ON "SCARFING" OR LENGTHENING OF TIMBERS.

BY MR. JAMES WYLSON.

(*Continued from page 63.*)

Fig. 13 is another form of a scarf with tablings, and is tightened by means of a pair of

Fig. 13 A.

wedges; *a* (fig. B) shews a tongue which may be formed on the extreme end of each of the

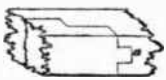

Fig. 13 B.

timbers, to resist the tendency which any force might have to bend the parts laterally out of their ranging position, and would be found convenient, from keeping the timbers in right position when in the first instance fitted together; another method is shewn in B, fig. 21.

Figs. 14 and 15 are for scarfs in tie-beams,

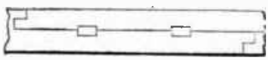

Fig. 14.

Fig. 15.

wherein bolts may be dispensed with unless great strength be required; but the keys must be such as can be fully depended upon, and should therefore be of a hard, tough, and incompressible wood, so as to keep the tongue which is on each end of the timber, securely in its proper place; the addition of bolts renders such scarfings of the first order; the former of the two examples is the easier to execute, and may perhaps be considered preferable on account of its thinest parts being less in extent than those of the latter.

Fig. 16 is the same scarf as fig. 14, but with

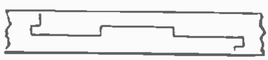

Fig. 16.

the wood well tabled together instead of being keyed.

Figs. 17, 18, and 19 are various modifications of one description of scarf; the first,

Fig. 17.

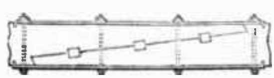

Fig. 18.

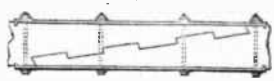

Fig. 19.

which is very common, is not very recommendable, since, if used as a tie, the oblique pressure has a tendency to make the two ends incline towards each other; and, if under compression, to have a contrary effect; the two latter, which only differ in the modes of affording them a means within themselves for resisting the strains lengthwise, are very much superior to the first, and are indeed very good and strong scarfs.

Figs. 20 and 21 are good ordinary scarfs, in

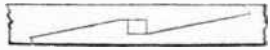

Fig. 20.

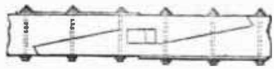

Fig. 21 A.

principle similar to fig. 15, but inferior to the same on account of the oblique joints; the clasp of the first may be improved by the insertion of a key; the second may be tightened up by wedges; the form shewn by B for cutting the

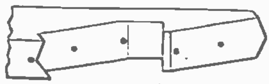

Fig. 21 B.

ends of the scarf is very convenient for fitting and keeping the pieces immoveably in their places.

Figs. 22, 23, and 24, are combinations peculiarly calculated for timbers sustaining a super-

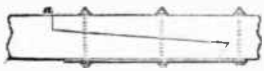

Fig. 22.

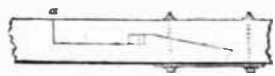

Fig. 23.

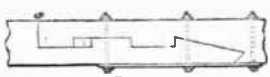

Fig. 24.

imposed weight. In bearing-timbers the upper half is in a state of compression, and the lower half in that of tension; and, therefore, the plain square form which in these examples has been adopted for the abutting-joint *a*, must be the best that can be employed under such circumstances. In the first of these scarfs the bolts and the turned ends of the plate afford the only check to the extending strain in the lower half, but the deficiency is made good in both the others by their being indented and wedged up.

The examples for scarfing which I have herein given (those of them having in their formation oblique parts excepted) are generally applicable also to the lengthening of *vertical* and *diagonal* supporting-timbers, such as posts and struts, it being only advisable to tongue the ends of the wood as shewn by figs. 13 *a*, or 21 B, though the better to ensure their remaining in their intended positions, and which tonguing might be introduced in the internal tablings as well as to the outside ends, wrought-iron collars being substituted for the upper and lower bolts. The *fished* timber, fig. 1, would require pieces on all the four sides.

According to Tredgold, the length of scarfs should be about—

For Oak, Ash, or Elm, without bolts	6 times the depth of the beam.
— Fir .. .. ditto	12 ditto.
— Oak, Ash, or Elm, depending on bolts only	3 times the breadth.
— Fir .. .. ditto	6 ditto.
— Oak and hard woods, bolts and indents combined ..	Twice the depth.
— Fir and soft woods .. ditto	4 times ditto